Mid Term Exam

Econ. 163b
March 3, 2005

72 MINUTES (one point per minute)
ANSWER EACH PART IN A SEPARATE BLUE BOOK

(24 minutes—4 minutes each)
I. Answer True/False/Uncertain. Explain your answers. No credit without explanation.

1. If two explanatory variables are highly correlated in a regression equation and have low t-statistics, a reasonable procedure is to drop the variable with the lower t-statistic and reestimate.
   False. If drop, have omitted variable bias.

2. If the error term is uncorrelated with all the explanatory variables in a regression equation and has zero mean, the least squares estimator is unbiased.
   False. Only consistent.

3. If \( y_t \) is regressed on a constant for the sample period \( t = 1, \ldots, n \), the \( R^2 \) will be zero if \( y_t \) has a mean of zero in the sample, but otherwise the \( R^2 \) will not necessarily be zero.
   False. \( R^2 \) always zero.

4. If all the \((k)\) explanatory variables in a regression equation are uncorrelated with each other, there is no reason aside from convenience to estimate the equation all at once (i.e., with a constant and all the explanatory variables included) as opposed to estimating \( k \) equations, where for each equation the left hand side variable is regressed on a constant and one of the explanatory variables.
   False. \( R^2 \) is larger so less precision.

5. Under the assumptions that \( E(u|X) = 0 \) and \( \text{var}(u|X) = \sigma^2 I \), one would never use any estimator other than ordinary least squares because by the Gauss-Markov theorem ordinary least squares is BLUE.
   False. Only part; do linear unbiased estimation, LDQ may be more robust.

6. If \( x_{tk} \) is omitted from a regression where \( \beta_k \neq 0 \), the bias in the estimate of \( \beta_2 \) will be larger the larger is the correlation between \( x_{tk} \) and \( x_{t2} \).
   False. Must regress \( y_t \) on all the \( x_t \)'s.
(28 minutes—7 minutes each)
II. Answer each of the following questions in the time allowed.

1. In a regression context, when it is appropriate to do a two-tailed t-test as opposed to a one-tailed t-test? Explain carefully what a p-value is.

2. What is a “dummy variable?” What assumptions, if any, of the standard linear regression model are violated when some of the explanatory variables are dummy variables? Is it possible to estimate an equation in which all the explanatory variables are dummy variables? Explain.

3. How would I estimate the following equation by ordinary least squares?

\[ Y_t = AL_t K_t^{1-\alpha} e^{\mu_t}, \quad t = 1, \ldots, n. \]

The coefficients to estimate are \( A \) and \( \alpha \) and the variance of \( u_t \), denoted, say, \( \sigma^2 \).

4. What is a “beta” or “standardized” coefficient? Why is this coefficient sometimes useful to compute?

(20 minutes—10 minutes each)
III. Answer each of the following questions in the time allowed.

1. Say I had the regression equation:

\[ y_t = y_0 + e_t + \beta_1 x_{1t} + \ldots + \beta_k x_{kt} + u_t, \quad t = 1, \ldots, n, \]

and wanted to test the hypothesis that \( \beta_1 = 4\beta_2 \) and \( \beta_5 = 6\beta_6 \). To perform an F-test, what steps would I follow assuming that I had a computer program that allowed me to run regressions and compute the sum of squared residuals for each regression? What does a large F value mean?

2. Consider the equation \( y = X\beta + u \), where \( \text{E}(u|X) = 0 \) and \( \text{var}(u|X) = \sigma^2 \Omega \). \( y \) is \( n \times 1 \), \( X \) is \( n \times k \), \( \beta \) is \( k \times 1 \), and \( u \) is \( n \times 1 \). \( \Omega \) is \( n \times n \). Assume that \( \Omega \) is a diagonal matrix where the first 10 diagonal elements are 1 and the remaining \( n - 10 \) diagonal elements are 2. What steps would I follow to compute the generalized least squares estimator of \( \beta \) in this case? In what sense is this estimator better than simply estimating the equation by ordinary least squares, since the ordinary least squares estimator is unbiased?